Abstract View

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A Numerical Model of Coastal Upwelling

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ABSTRACT

A wind-driven model of coastal upwelling induced into a stratified, rotating ocean is solved numerically. The circulation is on an *f* plane and longshore variations are neglected. A multilevel model is derived, but only solutions for a two-layer model are discussed. A longshore baroclinic surface jet is discovered. The time-dependent geostrophic jet is dynamically explained by conservation of potential vorticity. The existence of the jet depends critically on stratification and non-zero wind stress at the coast. Coastal upwelling is confined to within 30 km of the shore. The model exhibits no deep countercurrent during active coastal upwelling. A time scale of the order of 10 days or longer is required for a pycnocline at 50 m depth to penetrate the surface. Solutions for a wide (>300 km) coastal shelf, an irregular shallow shelf, and a continental slope region are illustrated. A secondary upwelling region is found offshore at sharp breaks in the shelf topography. In all cases, the offshore flow is a simple Ekman drift and downwelling offshore is created by Ekman pumping caused by negative wind-stress curl.